1999/00 ANNUAL COMBINED SEWER OVERFLOW REPORT RESUBMITTAL

King County Department of Natural Resources
Wastewater Treatment Division

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KING COUNTY
Department of Natural Resources

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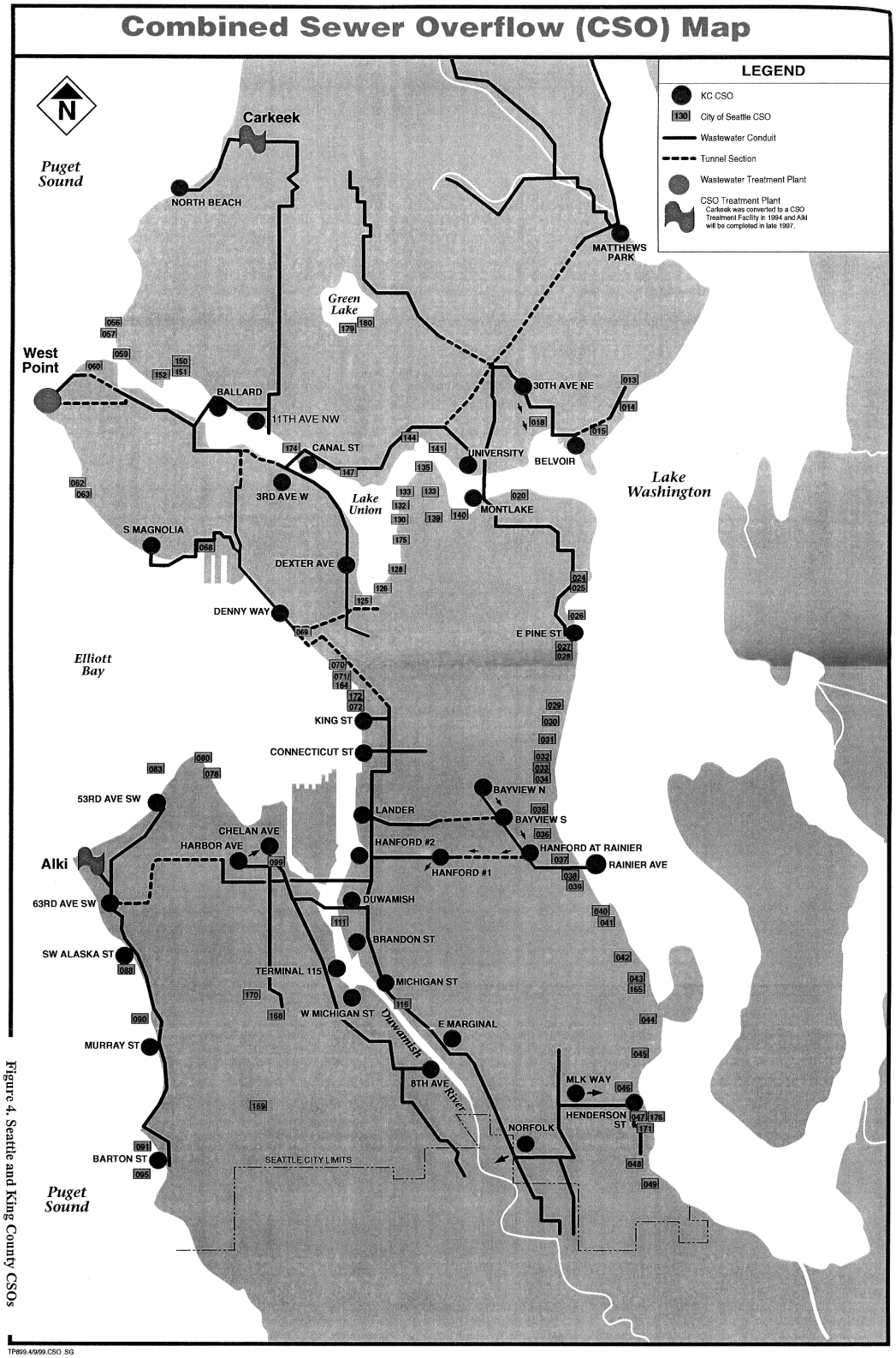


Figure 4. Seattle and King County CSOs

Section 1 - Overview and Status of CSO Control Program

1.1 Introduction

This report is prepared and submitted to the Department of Ecology (Ecology) in accordance with the requirements established within the West Point NPDES Permit, No. WA-002918-1 and in WAC 173-245-090. As outlined in the WAC, this report includes:

- An overview and status of King County Department of Natural Resources, Wastewater Treatment Division's (WTD's) CSO Control Program
- 1999/00 CSO overflow volume and frequency information
- This report includes the formal submission of the annual reports for the Alki (App.1) and Carkeek (App.2) CSO treatment plants

1.2 Background

King County Wastewater Treatment Division (WTD) provides wholesale wastewater conveyance and treatment for flows from the City of Seattle and thirty-three other cities and sewer districts. The City of Seattle collection system contains combined sewers that collect both sanitary sewage and stormwater. Seattle's wastewater collection system conveys flow to County trunks and interceptors, which then convey flows to the County's West Point treatment plant located in Discovery Park. When large storm events occur, flows may exceed the capacity of the collection system pipes, resulting in combined sewer overflows (CSOs) into Lake Washington, Lake Union, the Ship Canal, the Duwamish River, and Elliott Bay and Puget Sound (Figure 1-1). CSOs are a recognized source of water pollution that can result in aesthetic degradation of shorelines during CSO events and may adversely affect sediment quality at discharge points. CSOs may raise public health concerns in areas where there is potential for public contact.

Since the 1960s, King County has been conducting CSO control projects to improve water quality in the Seattle-King County area. The County first formalized its CSO control program with the development of its *1979 CSO Control Program (1979 Program*). The *1979 Program* identified nine projects to control CSO events into fresh water areas (Lake Washington, Lake Union, and the Ship Canal).

In 1985, new regulations were introduced with the Washington State Water Pollution Control Act (RCW 90.48) requiring all municipalities with CSOs to develop plans for "...the greatest reasonable reduction at the earliest possible date." The County's *1986 Plan for Secondary Treatment Facilities and Combined Sewer Overflow Control (1986 Plan*) met this state requirement.

Before the *1986 Plan* was implemented, new regulations were promulgated by Ecology. The new regulations (WAC 173-245-020) defined "greatest reasonable reduction" to mean, "control of each CSO such that an average of one untreated discharge may occur per year." The County worked with Ecology to develop an interim goal of 75 percent reduction of CSO volumes system wide by the end of 2005. The County's *Final 1988 Combined Sewer Overflow Control Plan (1988 Plan*) identified eleven CSO control projects designed to meet this interim goal. This interim goal was later cancelled by Ecology, allowing the County to prioritize control projects for their protection of human health rather than volume reduction.

As part of the 1995 renewal process for the West Point Treatment Plant NPDES permit, King County prepared an update/amendment to the *1988 Plan*. The *1995 CSO Update* included an assessment of the effectiveness of CSO reduction efforts to date, a re-evaluation of priority for CSO sites, and a list of 3 projects for the next five years.

In November 1999, *the Regional Wastewater Services Plan (RWSP)* was approved by the King County Council. The *RWSP* outlines wastewater projects to be built over the next 30 years to protect human health and the environment, serve population growth, and meet regulatory requirements. The *RWSP* includes the County's new CSO Control Plan, with twenty-one projects to control the County's remaining uncontrolled CSOs to one untreated event per year on average at each CSO location.

An update of the *RWSP*'s CSO Control Plan - the *Year 2000 CSO Control Plan Update* – was included in the June 2000 submission of the West Point NPDES permit renewal application to Ecology. Besides being required by state regulations, the *Year 2000 CSO Control Plan Update* documents King County's CSO control progress and compliance with state and federal CSO control requirements as of 2000, and commits to two very large control projects – Denny and Henderson/MLK/Norfolk - for the next five year NPDES permit cycle.

1.3 Status of CSO Control Projects

1.3.1 Completed CSO Control Projects

Table 1-1 and 1-2 summarize CSO control projects completed to date by King County

Table 1-1 Completed CSO Control Projects

Project	Description	Completion	Status
Diagonal Separation	Determined to be a City of Seattle Project	Early 1990s	Complete per City of Seattle
Ft. Lawton Tunnel	Parallel tunnel to West Point providing greater transfer capacity	1991	Complete
CATAD	Computer control of flows to maximize storage in the pipelines	Phase 1 1992	Phase 1 completed; On-going maintenance and improvement
Hanford/Bayview/ Lander Separation & Storage	Joint City/County partial separation of the Lander and Hanford basins, and reactivation of Bayview tunnel.	1992	Remaining control will occur under RWSP projects in 2017 (Hanford), 2019 (Lander) and 2026 (Hanford at Rainier). Lander stormwater mgmt on-going.
Carkeek Transfer/CSO Treatment	Flows up to 8.4 mgd from the Carkeek drainage basin are transferred to West Point. Flows above 8.4 mgd are treated at the Carkeek CSO Plant.	1994	The plant was found to receive more flow than anticipated. A study to recommend correction is near completion.
University Regulator/ Densmore Drain	Separation of Densmore & I-5 stormwater, as well as Greenlake drainage.	1994	Remaining control will occur under a RWSP project in 2015. Densmore stormwater mgmt on-going.
Kingdome Industrial Area Storage & Separation	In 1994 a pipeline (used for storage) was laid in conjunction with Seattle and WashDOT street projects. In 1999, the Public Facilities District (PFD) completed 60% of the level 1 separation between Alaska Way and 3rd Ave. in conjunction with stadium construction	1994, 1999	Remaining control will occur under a RWSP project in 2026.
Harbor Pipeline	A pipeline conveys overflow from the Harbor regulator to the West Seattle Tunnel for storage.	1996 (activated in 2000/01)	Not activated until tunnel operating experience gained. Will activate in 2000/01 wet season to achieve 1/y control.
Alki Transfer/CSO Treatment	Flows up to 18.9 mgd from the Alki drainage basin are transferred to West Point via the West Seattle Tunnel. Flows above 18.9 are treated at the Alki CSO plant.	1998	CSO plant modifications were completed in 1999. Harbor flows were not sent to the tunnel while operating experience was gained. Harbor flows will commence going to the tunnel in the 2000/01 wet season.
Denny Way/ Lake Union	Joint project with Seattle to capture Lake Union and Denny drainage flows for tunnel storage/treatment.	Expect on-line in 2004	Final design completed.
Henderson/MLK/ Norfolk	Two Lake Washington CSOs and 1 Duwamish River CSO will be controlled by tunnel storage/treatment.	Expect on-line in 2004	Final design completed.
63rd Ave. Pump Station	The West Seattle Tunnel was sized to store 63rd flows.	1998	Close to 1/yr. will monitor to check actual performance.

Table 1-2 Completed Associated Projects

Project	Description	Completion	Status
Renton Sludge Force Main Decommissioning	Sludge was pumped via the EBI to West Point for processing until Renton developed solids management capability; decommissioning may have decreased solids discharge from Interbay PS at Denny	1988	Complete
Denny Sediment Cap	Pilot sediment remediation project	1990	Remediation of remaining area of contamination is scheduled following overflow control
Allentown Diversion/Southern Transfer	Designed to offset addition of Alki flows to EBI. Side-benefit of significant volume reduction at Henderson and Norfolk	1995	Complete
CSO Monitoring Program: • NPDES Overflow & Sediments • Sediment Baseline	Initial characterization monitoring to identify project priorities; sediment characterization to identify clean up needs	1995, 1997	Complete
CSO Water Quality Assessment of the Duwamish River & Elliott Bay	Complex study to determine existing conditions and the relative contribution of CSO to pollution.	1999	Complete
Public Notification Program	A joint program between the City of Seattle, King County and the Sea-King County Health Department to make the public aware of CSOs and their risks. It involves signage, information hotline, and brochures	1999	Implementation complete. Now on-going.
Norfolk Sediment Remediation (1)	Source Control, dredging and capping	1999	Follow-up monitoring underway

(1) This project was done under the Elliott Bay/Duwamish Restoration Panel (EBDRP) under the consent decree settling the 1990 litigation by National Oceanic and Atmospheric Administration (NOAA) against the City of Seattle and King County (then Metro) for natural resource damages attributed to CSOs and storm drains.

1.3.2 Current CSO Projects

In the *2000 CSO Plan Update*, two continuing projects for CSO control were identified, as constituting the County's control activities for the next NPDES permit cycle – approximately 5 years. They are:

- Denny/Lake Union CSO Project
- Henderson/Martin Luther King Jr. Way/Norfolk CSO Control Project

The Denny/Lake Union CSO project will reduce CSO discharges from approximately 50 untreated discharges per year on average to one untreated discharge per year on average. Denny will have approximately 14 treated discharges per year. This project is expected to be completed by late 2004. The Henderson/Martin Luther King Way/Norfolk project will reduce CSO at those three locations to one untreated discharge per year on average. Norfolk will also have approximately 4 treated discharges per year. Completion for this project is expected by early 2004.

While not a part of the CSO Control Plan, but associated, the Carkeek Overflow Reduction Study - to determine the causes of the CSO plant receiving too much flow, and to recommend the correction alternative - is nearing completion. Implementation of the correction will commence as soon as possible.

1.3.2.1 Denny Way CSO Control Project

The *1986 Plan* identified a storage and treatment approach to controlling Denny Way overflows. In the *1988 Plan*, the Denny Way project was changed to include partial separation of 584 acres in the Denny/Lake Union and Denny Local drainage basins. Predesign for the project was scheduled to begin in 1993 with construction ending in 1999.

In late 1991, the Seattle Public Utilities (formerly Seattle Drainage and Wastewater Utility) requested that King County participate in a joint analysis of CSO alternatives to control discharges into Lake Union from Seattle's system and into Elliott Bay from the County's system at the Denny Way regulator station. In 1992, a joint Denny Way/Lake Union CSO Control Project was submitted as a candidate for Federal Infrastructure Grant funds. During 1994, a specific City of Seattle/King County, Denny Way/Lake Union joint CSO Control project was developed, and a $35 million Infrastructure Grant was awarded by the Environmental Protection Agency. The City completed construction of Phase 1 - a project to increase wet-weather capacity in the east and south Lake Union areas - in 1997. The City's Phase 2 project will connect their Phase 1 facilities to the County's Phase 3 and 4 facilities once they are completed.

Phase 3 (storage) and 4 (treatment) of the County's project were later combined. The Phase 3/4 project will control Lake Union and Denny Way CSOs by 1) storing CSO flows during small to moderate storms and transferring them to the West Point treatment plant after the storm subsides; and 2) providing on-site treatment at the Elliott West site with discharge of treated flows through a new outfall during heavy rain conditions. This will reduce untreated discharges from approximately 50/yr to 1/yr. Facilities include:

- a 6,200 ft. long and 14'8" diameter tunnel under Mercer Street between Dexter Avenue North and Elliott Avenue West (for CSO storage, primary clarification and conveyance)
- CSO control facilities at the Elliott West site (with floatable removal, disinfection, and dechlorination)

- piping and regulators to convey CSO flows from the existing County sewer system to the new facilities
- an outfall into Elliott Bay at Myrtle Edwards Park (to discharge treated flows from the Elliott West facilities)
- an extension of the existing outfall at the Denny regulator at Myrtle Edwards Park (to discharge untreated CSO flows, expected to occur about once per year)

A general milestone schedule for project implementation is shown below:

Preliminary Design Began	Spring 1997
Facilities Plan approved by Ecology	Fall 1998
Final Design Began	Fall 1998
Construction Begins	2000
Construction Complete	2004

A joint final State Environmental Policy Act (SEPA) Environmental Impact Statement (EIS)/National Environmental Policy Act (NEPA) Environmental Assessment for Phases 2 and 3/4 was issued in July 1998. Construction of the City and County projects are scheduled to be completed by the end of 2004.

1.3.2.2 Henderson/Martin Luther King Jr. Way/Norfolk CSO Control Project

At the time of adoption of the *1988 Plan*, the County believed that all CSOs into Lake Washington, including the discharge from the Henderson Street pump station and Martin Luther King Jr. Way overflow, had been controlled to the one event per year level. However, subsequent monitoring data indicated that overflows occurred more frequently than once per year at these locations.

As a result, in 1995 the County developed an engineering evaluation of the basin tributary to the Henderson/Martin Luther King Jr. Way CSOs to determine the sources and causes of the overflows at these locations, and identified interim and permanent corrective measures to control overflows. The evaluation also considered the impact of these measures on the downstream Norfolk regulator station. Based on this evaluation, the recommended alternative was to construct a 3.2-MG storage tank/CSO treatment facility near the Norfolk regulator station along with associated conveyance and pumping improvements.

During the 1997 predesign evaluation of alternatives, it was determined that a storage/treatment tunnel was more cost effective than the storage/treatment tank alternative. In addition, the storage tunnel had a conveyance system benefit, lower Operation and Maintenance, less adverse community impacts and was consistent with the approach being used on the Denny project. Therefore, the storage/treatment tunnel emerged from predesign as the preferred alternative. A 3,105 foot long and 14'8" diameter storage/treatment tunnel will be built to achieve the 1 untreated event per year level of control.

The Project elements and construction schedule are as follows:

Construction	Begins	Ends
• Henderson Pump Station	June 2001	June 2003
• Tunnel and Pipelines	July 2001	Jan 2004

1.3.2.3 Carkeek Overflow Reduction Study

This study is not part of the CSO Control Plan, but is associated. The Carkeek CSO Treatment Plant (on-line the end of 1994, but not really fully operational for another wet season) was found to be receiving more influent flow than had been identified and planned for, putting the County in violation of the NPDES permit limit of 14 MG/y of treated discharge. As we identified this problem an investigation was launched as a joint project with the City of Seattle (the local service provider in that area). The study found two things:

- Data used for the design of the Carkeek transfer and CSO plant was taken (mid-1980s) in what was, in retrospect, unusually dry years; and
- Unidentified overflows from the conveyance system (i.e. manholes) had been occurring and so were not accounted for in the measured loading to the plant. These flows have been captured as a result of system improvements and are now being transported to the Carkeek plant.

This means that the service area sends more flow than expected, and that the transfer to West Point was not designed to handle all of the area base flow. We have done an alternatives analysis in the study and are close to selecting the preferred alternative to address the increased volume. A significant part of the analysis involved preventing impacts to downstream CSOs (along the Ship Canal) so the solution may involve more than Carkeek. This makes the decision complex, involving the City, many neighborhoods and opportunities for concurrent projects. Ecology Northwest Regional Office has been briefed several times in 1999-2000. We will report on this project in the next (2001) annual report.

1.3.3 *Future RWSP Projects*

Table 1-2 lists all the CSO projects that comprise the CSO element of the *RWSP*. The table includes a brief description of the facilities to be constructed, and a proposed completion date. King County reserves the option to modify this schedule.

RWSP CSO Control Projects

Table 1-3

CSO Project	Project Description	Year Controlled
S. Magnolia	1.3 MG storage tank	2010
SW Alaska St.	0.7 MG storage tank	2010
Murray	0.8 MG storage	2010
Barton	Pump station upgrade	2011
North Beach	Storage tank and pump station upgrade	2011
Univ+Montlake	7.5 MG storage	2015
Hanford	3.3 MG storage/treatment tank	2017
West Point Improvements	Primary/secondary enhancements	2018
Lander	1.5 MG storage/treatment @ Hanford	2019
Michigan	2.2 MG storage/treatment tank	2022
Brandon	0.8 MG storage/treatment tank	2022
Chelan	4 MG storage tank	2024
Connecticut	2.1 MG storage/treatment tank	2026
King St.	Conveyance to Connecticut treatment	2026
Hanford@Rainier	0.6 MG storage tank	2026
8th Ave S	1.0 MG storage tank	2027
West Michigan	Conveyance upgrade	2027
Terminal 115	0.5 MG storage tank	2027
3rd Ave. W.	5.5 MG storage tank	2029
Ballard	1.0 MG storage tank (40% King County)	2029
11th Ave. West	2.0 MG storage tank	2030

1.3.4 On-going Program Elements

1.3.4.1 CATAD Modifications

The Computer Augmented Treatment and Disposal System (CATAD) controls the West Point treatment plant collection system. A new control program for the CATAD system was developed and brought on line in 1992 to improve utilization of storage capacity in existing sewers. The new control program included 3 components:

1) Raising storage levels behind regulator stations;
2) Lowering the wet well level at Interbay Pumping Station when rainfall was detected upstream, moving flow to West Point Treatment Plant sooner and vacating valuable storage space in the interceptor
3) Incorporating an optimization program (Predictive Control), which monitors rainfall and conditions in the major trunks and interceptors, predicts inflows to the sewer system, and optimizes the regulation of flow through the regulators to minimize CSOs.

These modifications to the system have been estimated to reduce CSO volumes by 150 MG per year, when all are operating as designed.

All three elements of the project were completed. However, problems at Interbay Pump Station and with the computer hardware at West Point now prevent the use of the second and third (Predictive Control) components. Improvements to the Interbay Pump Station are underway to ensure consistent successful operation of the pump station in "CSO mode" (lowering the wet well operating level) during storm events without entraining air into the pumps. Computer hardware and system software upgrades are being scheduled, which will enable operation of the "Predictive Control Program". Modifications to the Predictive Control program are continually needed to incorporate new flow transfer projects and to improve the efficiency and robustness of the optimization program.

1.3.4.2 Lander and Densmore Stormwater Management Program

As a result of County sewer separation projects creating stormwater-only discharges, King County and the City of Seattle now jointly conduct a stormwater management program in the Lander and Densmore drainage basins under the NPDES municipal stormwater permit. This is an on-going program that includes the following elements: source control, baseline sampling of stormwater discharges, and inspections. The maintenance of the stormwater system, the development of compliance schedules and enforcement actions are to be managed by the City of Seattle as specified in an interlocal agreement by and between the City of Seattle and King County.

1.3.4.3 CSO Notification Program

In order to meet state and federal requirements for public notification and to provide information to the community regarding the possible health impacts of CSOs, King County Department of Natural Resources (KCDNR), the Seattle-King County Health Department (SKCHD) and the City of Seattle Public Utilities (SPU) have collaborated on the development of a CSO Public Notification/Posting Program. Ecology was briefed on the program and accepted its development and components. This program includes posting warning signs at King County and City of Seattle CSOs, an information phone number for the public to contact the Seattle-King

County Health Department (SKCHD) on questions concerning CSOs, a brochure, website, and other outreach efforts.

The CSO signs include a graphic, some text, the SKCHD information phone number, as well as a CSO number assigned to each site, which corresponds to its NPDES discharge serial number.

Due to the low volume of calls to the CSO Notification Information line to date, King County, City of Seattle, and the Seattle-King County Department of Health will be discussing future options for the phone line. Further formal reports may not be necessary.

Section 2 – 1999/00 CSO Volume and Frequency Summary

2.1 Introduction

The County's CATAD System monitors the volume and frequency of CSOs at regulator and pump stations in the West Point treatment plant system. Figure 1-1 at the front of this report shows the location of existing King County and City of Seattle CSO discharges. The area south of the Ship Canal is referred to as the Southern Service Area, and the area north of the Ship Canal (including the Montlake and Dexter regulator stations) is referred to as the Northern Service Area. The County deploys portable flowmeters at the following eleven CSO locations not currently monitored by CATAD: 11th Ave. NW, 53rd Ave. SW, 63rd Ave PS, Alaska Street (SW), , Barton PS, Henderson Street, Magnolia (South), Martin Luther King Jr. Way, Murray PS, North Beach PS, and Terminal 115. As shown on Table 2-1, rainfall measured by County rain gauges at pump and regulator stations for the 1999/00 reporting period averaged 31.75 inches. This is 14.2% below the average rainfall of 37 inches per year and indicates a pattern of less intense storms and better system recovery periods. Rain gauges at pump and regulator stations giving questionable data are not reported here. Replacement and calibration are underway.

Table 2-1
1999/00 Rainfall at Pump and Regulator Stations
(in inches)

													1999/00
Station	Jun-99	Jul-99	Aug-99	Sep-99	Oct-99	Nov-99	Dec-99	Jan-00	Feb-00	Mar-00	Apr-99	May-99	Total
Denny Local	1.50	0.50	0.35	0.24	1.89	8.62	3.62	3.26	3.63	2.74	0.60	2.26	29.21
King Street	1.48	0.75	0.65	0.28	1.88	8.90	3.85	3.45	3.64	2.74	0.69	2.27	30.58
Ballard	2.17	1.19	0.57	0.39	2.25	8.44	3.87	3.53	3.73	2.57	0.78	2.27	31.76
University	1.88	1.20	0.97	0.70	2.47	9.70	4.32	3.92	4.04	3.02	0.92	2.91	36.05
East Marginal	0.56	1.01	0.66	0.20	1.40	8.76	4.00	3.47	3.74	2.53	0.73	1.95	29.01
Henderson	1.65	0.95	1.14	0.18	2.18	9.55	4.41	2.94	1.88	1.06	0.73	1.76	28.43
East Pine Street	1.29	0.77	1.09	0.09	2.07	9.77	4.36	3.37	3.82	3.16	0.85	1.74	32.38
Matthews Park	2.40	1.36	0.84	0.61	1.80	9.43	4.33	4.22	4.09	3.09	1.33	3.12	36.62
Average	1.62	0.97	0.78	0.34	1.99	9.15	4.09	3.52	3.57	2.61	0.83	2.29	31.75
Italics indicate estimated data													

2.2 1999/00 CSO Volumes

The total system overflow volume for 1999/00 was 587 million gallons (MG), compared to the 1981-3 baseline of 2,339 MG. Of this, 39 MG overflowed in the northern service area and 548 in the southern service area. While this represents a 75% reduction in volume from 1983, this may not be representative of control progress

alone. This reduction reflects a year of below average rainfall and lower than average intensity storm events, as well as the completion of CSO control projects. Unusual data noted include:

- Harbor erroneously showed no overflow. The "set point" was apparently programmed wrong during construction, which caused the overflow to go over the back up weir without measurement. Once the set point was re-programmed, the bubbler was found to not be working. Therefore overflows were not recorded, and 1999/00 flow and volume for Harbor are unknown. Repair is underway. Recent modeling of the system estimates that Harbor would overflow 36 MG as a long-term average. This coming 2000-2001 wet season will see Harbor flows being routed to the West Seattle tunnel for control of the overflow.
- Very large storms in November generated more than 40% of the year's CSO volume. December and February generated another 20% each.
- Carkeek Park CSO Plant's discharge was lower than in previous years, but its 5-year average exceeded the NPDES volume limit. A joint City/County study to develop a correction is near completion.
- Alki CSO Plant discharged much less than the permitted levels of up to 29 events/year and 108 MG/yr during this reporting period. This is due to the County's decision to defer storage of Harbor CSO flows in the tunnel until more system operating experience was gained. Harbor flows will go to the tunnel beginning in the 2000/01 wet season, leaving less room for Alki flows, and resulting in greater operation of the Alki CSO treatment plant with discharges approaching permitted levels.

2.2.1 1999/00 CSO Volume Control Progress

Table 2-2 contains the monthly overflow volumes and comparisons to revised baseline conditions for each station.

Table 2-2
1999/00 CSO Volume Summary
(in million gallons)

Station	DSN	Service Area	Jun-99	Jul-99	Aug-99	Sep-99	Oct-99	Nov-99	Dec-99	Jan-00	Feb-00	Mar-00	Apr-00	May-00	Total (MG)	Baseline (MG)
11th Ave NW [1]	004	North	4.9	0.2	0.0	0.0	0.0	1.0	1.2	0.7	3.3	0.0	0.0	0.0	11.3	**5**
30th Ave. NE	049	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
3rd Ave. W.	008	North	0.4	0	0	0	0	2.6	2.6	0	0.4	0	0	0	6	106
53rd Ave. SW[1]	052	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
63rd Ave. PS[1]	054	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	10
8th Ave./W. Marginal Way	040	South	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Alaska St. SW	055	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Ballard	003	North	0.3	0	0	0	0	0	1.8	0	0.1	0	0	0	0.2	95
Barton [1]	057	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Belvoir	012		0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Brandon St.	041	South	0.4	0.1	0	0	0.3	9.1	7.2	2.2	6.1	1	0.2	0.3	26.9	64
Canal St.	007	North	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chelan	036	South	0	0	0	0	0	1	0.6	0	0	0	0	0	1.6	61
Connecticut	029	South	0	0	0	0	0	0	0	0	0	0	0	0	0	90
Denny Way	027	South	21.6	0.3	0	0.3	3.8	175	79.8	17.9	79	18.6	0	6.3	402.6	502

Table 2-2 continued																
Station	**DSN**	**Service Area**	**Jun-99**	**Jul-99**	**Aug-99**	**Sep-99**	**Oct-99**	**Nov-99**	**Dec-99**	**Jan-00**	**Feb-00**	**Mar-00**	**Apr-00**	**May-00**	**Total (MG)**	**Baseline (MG)**
Dexter	009	North	0.6	0.1	0	0.1	0	0.9	1.4	0	0.2	2	0	0	5.3	24
Duwamish P.S.	034	South	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Hanford	031/2	South	9.3	0	0	0	0	17.7	5.6	0.4	11.2	2.2	0	0	46.5	644
Harbor Ave.	037	South	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N/A	36
Henderson [1]	045	South	0.8	0.1	0	0	0	0	0	0	0	0	0	0	0.9	15
King Street	028	South	0.9	0	0	0	0	8.6	4.6	0.6	4.5	0.5	0	0	19.6	55
Lander II St.	030	South	0.6	0	0	0	0	13.3	11	2	5.6	2.7	0	0	35.2	143
Magnolia, S [1]	006	South	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Marginal, E	043	South	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Matthews Park	018	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Michigan.	039	South	0.7	0	0	0	0	6.4	3.3	0.1	3	0.1	0	0	13.5	190
Michigan, W.	042	South	0	0	0	0	0	0.2	0.2	0	0.1	0	0	0	0.5	2
MLK Jr. Way [1]	013	South	0.2	0	0.4	0	0	0	0	0	0	0	0	0	0.5	60
Montlake	014	North	0.8	0	0.2	0	0	0	0	0	0	0	0	0	1	32
Murray [1]	056	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Norfolk St.	044	South	0	0	0	0	0	0	0	0	0	0	0	0	0	39
North Beach [1]	048	North	0.4	0	0	0	0	0.2	0.3	0.4	0.2	0	0	0	1.5	6
Pine, E St.	011	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Rainier Ave.	033	South	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Terminal 115 [1]	038	South													N/A	2
University	015	North	8	0	0	0	0	0	4	0	0	0	0	0	12.1	126
																0
TOTAL			49.8	0.8	0.6	0.4	4.1	235.9	123.8	24.2	113.7	27	0.2	17.3	587.3	2339
1999/00 Rainfall Average (in inches)			1.62	0.97	0.78	0.34	1.99	9.15	4.09	3.52	3.57	2.61	0.83	2.29	31.75	37 historical average
CSO TREATMENT PLANTS:																
Alki Plant	051		0	0	0	0	0	2.12	0	0	1.80	0	0	0	4	108 [3]
Carkeek Plant	046		0.65	0	0	0	0	6.89	0.52	0	0.32	0	0	0	8	14 [3]

(1) Portable flow meters; not currently monitored by CATAD.
(2) Baseline for both CSO frequency and volumes have been revised since the 1988 final CSO Plan due to improvements made to the computer modeling system that provide more accurate projections on historical and future conditions
(3) NPDES Permit Limit

Figure 2-1 graphically illustrates the relationship between rainfall and CSO volumes during this 1999/00 reporting period.

Figure 2-1. 1999/00 CSO Volume vs. Rainfall

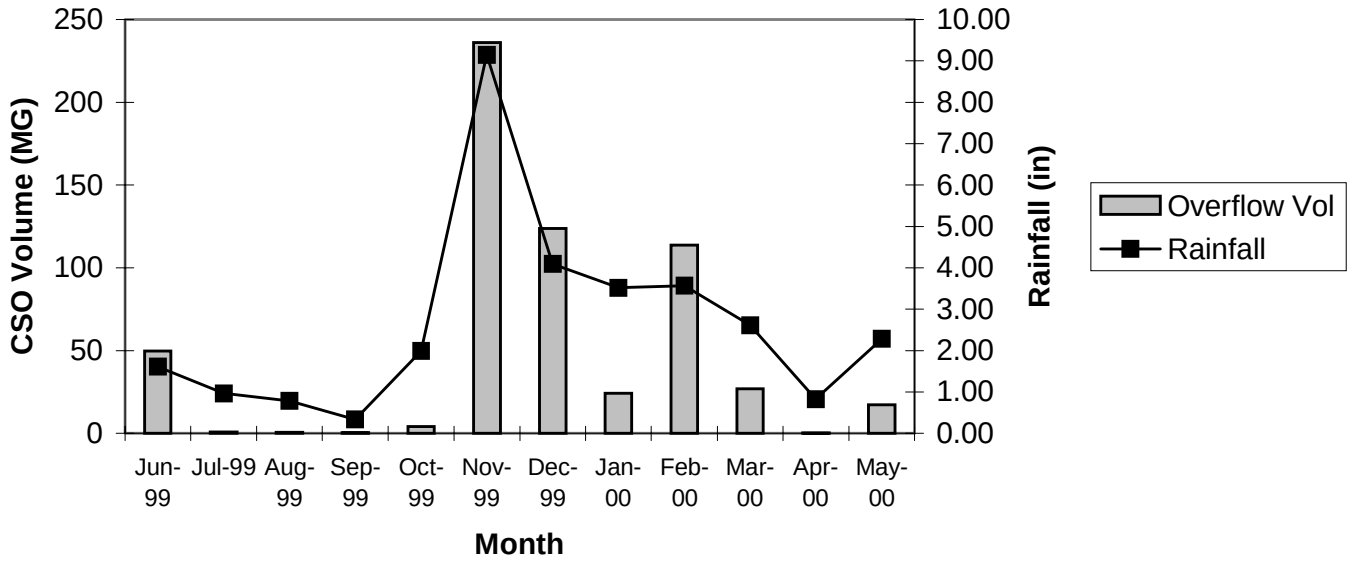
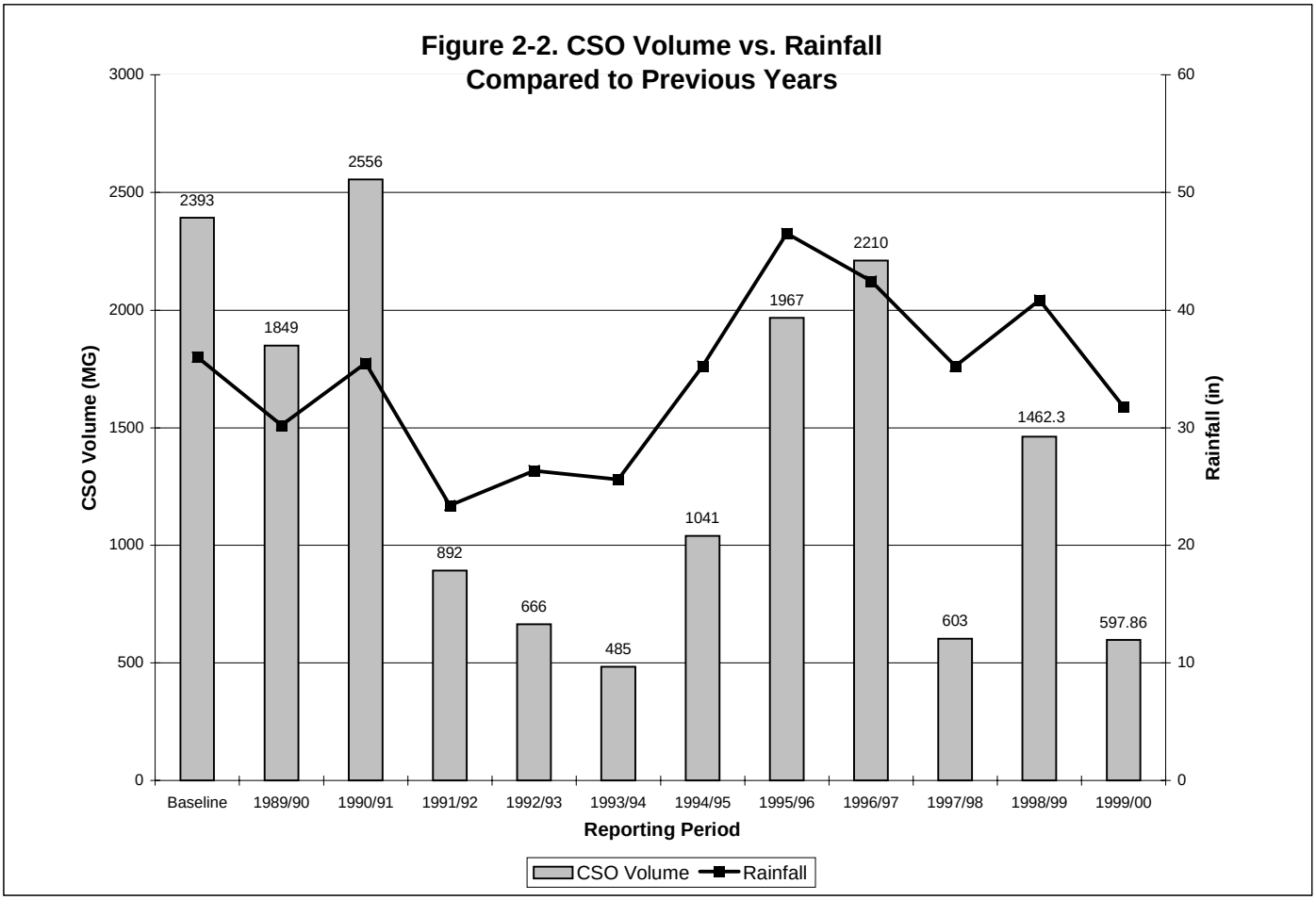


Figure 2-2 illustrates the progress King County has made in CSO volume control over time.



2.3 1999/00 CSO Event Frequency

The total number of overflow events for 1999/00 was 198, compared to the 1981-3 baseline of 431. While this represents a 54% reduction in events from 1983, this may not be representative of control progress alone. This reduction reflects a year of below average rainfall and lower than average intensity storm events, as well as the completion of CSO control projects.

When the County (then Metro) originally began CSO control planning we defined a CSO "event" as an overflow preceded and followed by 3 hours without overflow – 3 hours was the chosen "inter-event interval." Over time we noticed that many small overflow events were occurring during a single rainstorm –suggesting that our inter-event interval definition was incorrect. In 1995 our consultant conducted a statistical assessment of how long the inter-event interval needed to be such that no more than one overflow would occur per rainstorm. The results of the analysis showed a 40 (48 for reporting convenience) hour interval achieved the one storm/one overflow goal. We submitted a copy of the analysis to Ecology's Northwest Regional Office. Between 1995 and 2000 we reported data based on both the 3 hr. and 48 hr. intervals in our annual CSO reports.

We were satisfied with the use of the 48-hour interval and made the switch formally in our *Year 2000 CSO Plan Update*, submitted with the West Point NPDES permit renewal in June 2000.

Just as we were finalizing that *Plan Update* report Ecology began a process to define the inter-event interval for themselves (based on requests from other municipalities). The last draft of Ecology's proposed inter-event interval guidance indicated that a 24-hour interval might be chosen. King County has performed an initial analysis of the effect of this new interval on the sizing of planned facilities. This first analysis shows this change would not significantly change the sizing of future control facilities or effect our control schedule, but it would require a significant re-vamping of our software for calculating frequency, and a remodeling of our baseline conditions. Assuming that the Ecology guidance is finalized this year, we will begin reporting frequency using a new event definition in the next (2001) annual report.

2.3.1 1999/00 CSO Event Frequency Control Progress

Table 2-3 contains the monthly frequencies and comparisons to revised baseline conditions for each station.

Table 2-3
1999/00 CSO Event Frequency Summary
(Based on 48-hour Inter-Event Interval)

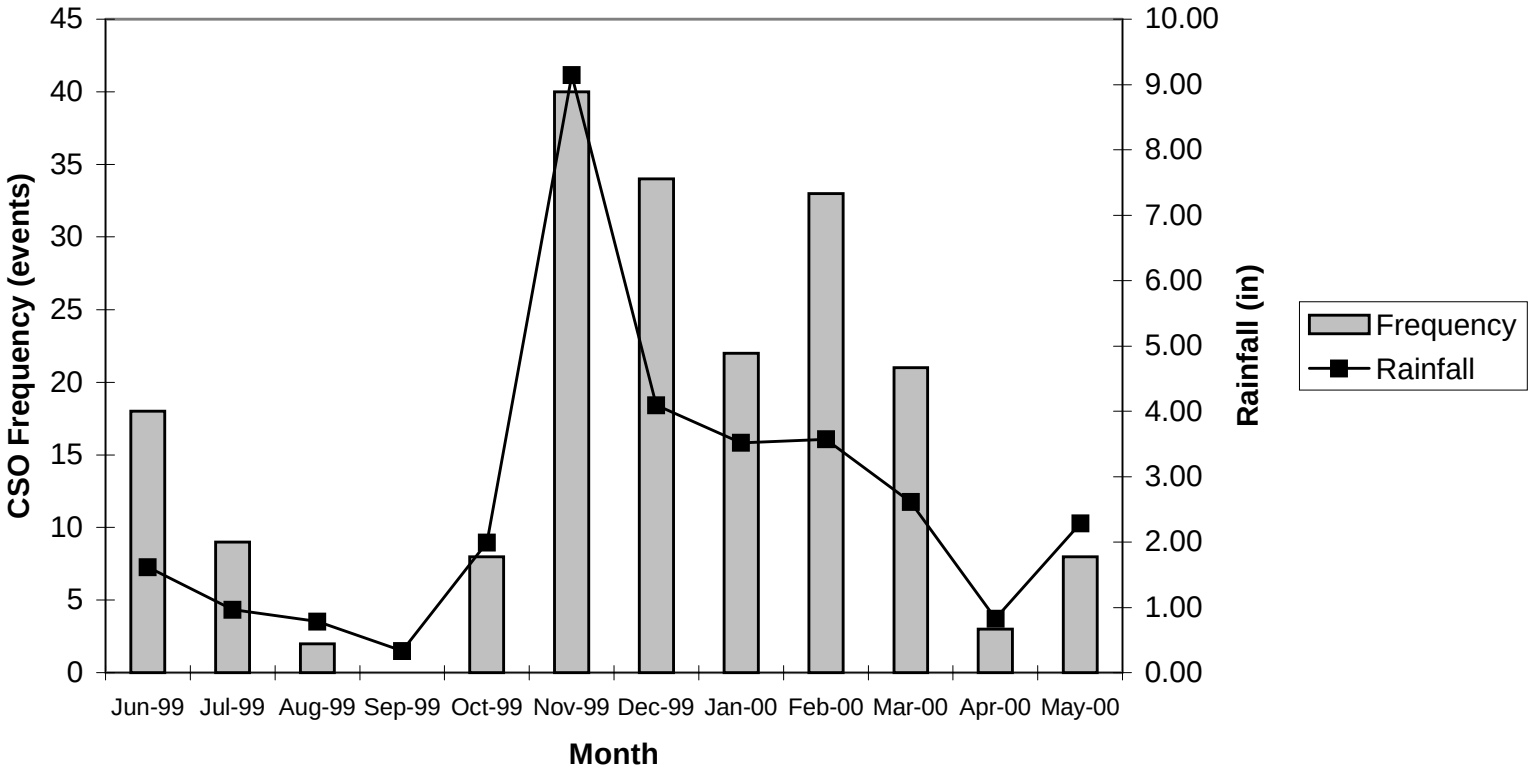
Station	DSN	Service Area	Jun-99	Jul-99	Aug-99	Sep-99	Oct-99	Nov-99	Dec-99	Jan-00	Feb-00	Mar-00	Apr-00	May-00	Total (Ev/yr)	Baseline (Ev/yr)
11th Ave NW [1]	004	North	2	2	0	0	1	3	2	2	3	0	0	0	15	**14**
30th Ave. NE	049	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
3rd Ave. W.	008	North	0	0	0	0	0	0	0	0	0	0	0	0	0	15
53rd Ave. SW[1]	052	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
63rd Ave. PS[1]	054	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8th Ave./W. Marginal Way	040	South	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Alaska St., SW [1]	055	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ballard	003	North	1	0	0	0	0	0	1	0	2	1	0	0	5	13
Barton [1]	057	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Belvoir	012	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Brandon St.	041	South	1	2	0	0	3	6	5	4	5	3	2	2	33	32
Canal St.	007	North	1	0	0	0	0	0	0	0	0	0	0	0	1	1
Chelan	036	South	0	0	0	0	0	1	1	0	0	0	0	0	2	7
Connecticut	029	South	1	0	0	0	0	0	0	0	0	0	0	0	1	23
Denny Way	027	South	1	1	0	0	2	6	6	2	4	3	0	2	27	25
Dexter	009	North	1	1	0	0	0	3	0	0	2	2	1	0	10	15
Duwamish P.S.	034	South	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Hanford	031/2	South	1	0	0	0	0	5	3	2	3	3	0	0	17	63
Harbor Ave.	037	South	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N/A	26
Henderson [1]	045	South	1	1	1	0	2	7	5	5	3	5	0	2	32	11
King Street	028	South	1	0	0	0	0	2	3	2	3	1	0	0	12	14
Lander II St.	030	South	1	0	0	0	0	3	2	2	2	3	0	0	13	22
Magnolia, S [1]	006	South	0	0	0	0	0	0	0	0	0	0	0	0	0	21
Marginal, E	043	South	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Matthews Park	018	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Michigan.	039	South	1	0	0	0	0	1	2	1	2	1	0	1	9	32
Michigan, W.	042	South	0	0	0	0	0	1	1	0	1	0	0	0	3	5
MLK Jr. Way [1]	013	South	1	0	1	0	0	0	0	0	0	0	0	0	2	15
Montlake	014	North	1	0	0	0	0	0	0	0	0	0	0	0	1	5
Murray [1]	056	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Norfolk St.	044	South	0	0	0	0	0	0	0	0	0	0	0	0	0	18
North Beach (1)	048	North	2	2	0	0	0	2	1	2	2	0	0	1	12	17
Pine, E St.	011	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Rainier Ave.	033	South	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Terminal 115 [1]	038	South													N/A	3
University	015	North	1	0	0	0	0	0	2	0	0	0	0	0	3	12
TOTAL			18	9	2	0	8	40	34	22	33	21	3	8	198	431
1999/00 Rainfall Average (in inches)			1.62	0.97	0.78	0.34	1.99	9.15	4.09	3.52	3.57	2.61	0.83	2.29	31.75	37 historical average

Table 2-3 continued																
Station	**DSN**	**Service Area**	**Jun-99**	**Jul-99**	**Aug-99**	**Sep-99**	**Oct-99**	**Nov-99**	**Dec-99**	**Jan-00**	**Feb-00**	**Mar-00**	**Apr-00**	**May-00**	**Total (Ev/yr)**	**Baseline (Ev/yr)**
CSO TREATMENT PLANTS:																
Alki Plant	051	South	0	0	0	0	0	1	0	0	1	0	0	0	2	29 [3]
Carkeek Plant	046	North	1	0	0	0	0	2	2	0	1	0	0	0	6	8 [3]

(1) Portable flow meters; not currently monitored by CATAD.
(2) Baseline for both CSO frequency and volumes have been revised since the 1988 final CSO Plan due to improvements made to the computer modeling system that provide more accurate projections of historical and future conditions
(3) NPDES Permit Limit

Figure 2-3 graphically illustrates the relationship between rainfall and CSO frequency during this 1999/00 reporting period.

Figure 2-3. 1999/00 CSO Event Frequency vs. Rainfall
(based on 48 hour inter-event interval)



2.4 CSO Treatment Plant Performance

King County currently operates two CSO treatment facilities, the Alki and Carkeek Park CSO treatment plants. These plants are part of systems that transfer base flows (2.25xAWWF –Average Wet Weather Flow), a small amount of stored flow, and solids removed during CSO treatment to the West Point Plant. Flows above the base are sent to the CSO treatment plants where they receive primary treatment, disinfection and discharge to Puget Sound through a moderately deep outfall. Carkeek transfers up to 8.4MGD to West Point and Alki transfers up to 19MGD. Two new facilities - storage/treatment tunnels - are in final design for the Denny and the Henderson/MLK/Norfolk locations. They are expected to be on-line in 2004.

2.4.1 Alki CSO Plant

The Alki CSO treatment plant operated 3 times and discharged 2 times for a total of 3.9 MG discharged during the year. The Alki plant performed within the permit limitations, even without dropping a storm event. The average TSS removal for the reporting year was 68%, while the annual average effluent TSS was 26.2 mg/l. This is well under the 60 mg/l surrogate limit for 50% removal. Annual average effluent settleable solids and event maximum effluent settleable solids met both the annual average limit (0.3 ml/L/hr) and per event maximum limit (1.9 ml/L/hr permit limits).

See Appendix 1 - the plant specific annual report - for more detail.

Alki has benefited from the temporary extra capacity in the West Seattle Tunnel – sending extra flow to the tunnel before the routing of Harbor CSO flows begins. In the 2000/01 wet season it is expected that Alki will discharge more effluent – closer to the 108 MGY that was planned - and perhaps discharge more frequently (up to 29 per year on a 5 year average), than has been observed once operation becomes as designed.

2.4.2 Carkeek Park CSO Plant

The Carkeek CSO treatment plant operated 20 times and discharged 6 times for a total of 8 MG discharged during the year. The effluent met the annual permit limits with 34 mg/L total suspended solids and <0.1 ml/l/hr settleable solids. No violations of the SS maximum event limit occurred.

See Appendix 2 - the plant specific annual report - for more detail.

The overflow volume was down compared to previous years, but the past years' higher volumes placed the plant in violation of its 5-year average flow NPDES permit limit. Since this extra volume is expected as the long-term trend, the Carkeek Overflow Reduction Study was done. Construction on any correction will commence as soon as possible.

Appendix 1 - Alki CSO Plant Annual Report

This document constitutes the first annual report of the Alki Treatment Plant as a CSO facility, and summarizes its performance and operation during the period of June 1999 to May 2000. The plant was available for CSO operation on October 1, 1998. Though operated as a CSO treatment facility after that date, Alki was not incorporated into West Point's NPDES permit as a CSO treatment facility until Oct. 1999. During this interim period, Alki was operated and monitored to meet permit requirements similar to those for the Carkeek Park CSO Plant. On October 25, 1999, new permit requirements for the Alki plant were included with the permit for the West Point Treatment Plant (WA-0029181-1). The annual reporting period is now scheduled to be concurrent with annual CSO reporting period, June 1- May 31. Alki previously operated under permit WA-002901-7 as a primary treatment plant. Alki ceased operation as a primary treatment facility on July 15, 1998.

Performance

The Alki CSO facility effluent limits are defined as follows:

- discharge of suspended solids is limited to a yearly average of events of 60 mg/l or less
- settleable solids will be limited to 1.9 or less ml/l/hr per event
- settleable solids will be limited to a yearly average of 0.3 or less ml/l/hr.

During the permit cycle (a five year period), the number of events per year is limited to an average of 29 and flow is limited to an average of 108 million gallons per year.

The number of events and total flow discharged from the plant to date has been much lower than permitted. This is expected to increase substantially beginning in wet season 00/01 due to the planned addition of Harbor CSO flows. Harbor CSO flows have not been allowed during the first year of operation following upgrade of the Alki plant to allow us to gain plant and tunnel operating experience with a margin of safety. Attached are two spreadsheets summarizing the plant's operation and performance during reporting period, June 1, 1999 through May 31, 2000.

Operation

Between the first and second year of operation, (April 1999 to October 1999), the Alki plant was remodeled to operate as an automated CSO treatment facility. Plant modifications were made to the disinfection system (converted from chlorine to hypochlorite), the preaeration system (to better handle the high grit load), the raw sludge, circulation pumps and primary sedimentation tanks, and the data acquisition and control systems. The modified system allows the primary sedimentation tanks to be filled in different sequences depending on the magnitude of the flow. As soon as the primary sedimentation tanks are filled, raw sewage pumps begin to pump captured sludge to the West Seattle Tunnel. The automated chemical feed system allows the addition of hypochlorite at the influent and/or effluent, and can be controlled by flow and two chlorine residual analyzers in the contact channel. Influent and effluent samplers are programmed to take flow-placed samples. Plant modifications also included modifying the plant heating and process water systems. The data acquisition system was designed so that it can eventually be tied into the distributed control system at Renton.

Before November 12, 1999, the contractor performed three tests on the new equipment. The sedimentation tanks were filled during each test to simulate different flow conditions. After each test the tanks were pumped back to the regulator trunk and no effluent was discharged.

The modified CSO plant was in operation for three events between November 1999 and February 2000. During two of the events, discharges occurred. During all three events, the West Seattle Pumping Station pumped 18.9 – 19 MGD. Captured solids were pumped back to the West Seattle Tunnel as soon as a primary tank was full. All of the flow that was not discharged as a treated CSO effluent was pumped to the West Seattle Tunnel. Sampling procedures were followed according to the permit requirements.

As expected with new facilities, adjustments were necessary to make the plant more reliable and more effective. For example, the raw sludge pumps had to be modified because they often lost their prime. A retrofit for these failures has been engineered and installed. Some adjustment to the scum sprays, although not part of the new modifications will need to be made.

Numerous adjustments were made to the hypochlorite disinfection system to provide a more reliable and effective disinfection system. The adjustments were required partly because the hypochlorite tends to off-gas and cause the hypochlorite feed pumps to loose their prime/suction. A control program change and pump setting change eliminated one source of failure. This provided some relief from problems of under and then overdosing. Also, there are plans to change out valves on the hypochlorite lines within the next two months. The hypochlorite dosing rate needed for disinfection at Alki was fairly low compared with the capacity of the dosing pumps. This exacerbated the other problems. Hypochlorite is now diluted down to a 4% solution before application to provide for higher flow rates through the pumps, thus making them more reliable. The solution is also more stable at this concentration. Hypochlorite is principally added to the plant influent (rather than the effluent). This provides better control of the effluent chlorine residual and a much longer contact time. We were able to achieve reliable disinfection for the last two discharge events of the year.

Significant work was also performed to improve the data communications between Alki and the South Treatment Plant. Staff at the division control in the South Treatment Plant at Renton can now monitor conditions at the Alki plant. Work on a operations and maintenance manual for the Alki CSO facility is underway.

Following is a summary of Alki's performance during this period:

- All events were used in the calculation - none were dropped under the provision for one untreated (or poorly treated) discharge per year
- Two discharges events occurred compared to the 29 events permitted as 5-year average
- 3.92 MG were discharged compared to the 108 MG 5-year average limit
- No settleable solids (SS) maximum event violations occurred
- The annual SS average was 0.2 ml/L/hr, compared to the 0.3 limit
- The annual Total Suspended Solids (TSS) concentration was 26.2 mg/L compared to the 60 mg/L limit – this equivalent to 68 percent TSS removal

Table A1-1 Alki Settleable Solids (SS) Performance

June 1, 1999 through May 31, 2000

Date	Effluent Event #	Settleable solids (mls/L/hr)	Event Maximum (ml/L/hr)	Event Average (ml/L/hr)	Comments
11/12/99	1	**<0.1**, <0.1, <0.1, <0.1	<0.1	<0.1	
2/1/00	2	**0.4**, 0.1	0.4	0.4	
Annual Event Average				**0.2**	

Details on the above information is provided below:

- <0.1 is detection limit; bold type indicates value used for the day in the event (highest when multiple tests are run during the day).
- Calculation of average settleable solids values uses 0.0 when value is < 0.1.
- Event average = average of daily values during an event.
- Annual event average = average of all event averages during the reporting year.
- All events were included in the calculations.
- Flow data is reported daily from 00:00 hours to 23:59 hours.
- Sample data is taken from 00:00 hours to 23:59 hours.

Table A1-2 Alki Total Suspended Solids (TSS) Performance

June 1, 1999 through May 31, 2000

Date	Inflow Event Number	Influent Flow (MG)	Influent TSS (mg/l)	Discharge Event Number	Effluent Flow (MG)	Effluent TSS (mg/l)	Discharge Event Effluent TSS (mg/L)	WPTP TSS removal (%)	Influent TSS lbs of solids	Alki TSS lbs discharged - outfall	Solids pumped to WPTP (TSS lbs)	Alki solids (lbs. TSS) treated out with WP effluent	Total Alki solids out (Alki+WP)	Alki CSO Treatment "System" TSS Removal (%)
11/12/99	1	6.16	41.4	1	2.12	25.6	25.6	71.0%	2,126.9	452.6	1,674.3	485.5	938.2	56%
12/15/99	2	1.39	166		0.00	0		86.0%	1,924.4	0.0	1,924.4	269.4	269.4	86%
2/1/00	3	3.30	151	2	1.80	26.8	26.8	72.0%	4,155.8	402.3	3,753.5	1,051.0	1,453.3	65%
Annual Totals	**3**	**10.85**		**2**	**3.92**				**8,207.1**	**855.0**	**7,352.1**	**1,805.9**	**2,660.9**	
Annual Event Average							**26.2**							**68%**

Details on the above information is provided below:

- Flow data is reported daily from 00:00 hours to 23:59 hours.
- Sample data is taken from 00:00 hours to 23:59 hours.
- Alki influent poundage calculation: lbs = (volume in Million Gallons) x (concentration) x 8.34
- Transfer pounds out = Alki lbs. out + (Alki lbs in-Alki lbs out) x (1-WP TSS removal)
- Total Solids Out (Alki+West Point) = (Alki pounds out) + (transfer pounds out with WP effluent),
- Event Effluent Concentration = (total event pounds)/total event volume x 8.34)
- Annual Average Event Effluent Concentration = (sum of event concentrations)/number of events.
- Annual values were calculated using all of the events.

Appendix 2 (A2) – Carkeek CSO Plant Annual Report

This document constitutes the fifth annual report of the Carkeek plant as a CSO facility and summarizes its performance and operation during the period of June 1999- May 2000. The plant was placed into CSO operation November 1, 1994, under Carkeek's then existing wastewater treatment plant permit. The annual reporting period was modified October 25, 1999 to schedule concurrent with annual CSO reporting period, June 1- May 31.

Performance

The Carkeek CSO facility operates under the Washington State Department of Ecology permit number WA-0029181-1 issued to the West Point treatment plant. As of July 1, 1998, the Carkeek effluent limits are defined as follows:

- discharge of suspended solids is limited to a yearly average of events of 60 mg/l or less
- settleable solids will be limited to 1.9 or less ml/l/hr per event
- settleable solids will be limited to a yearly average of 0.3 or less ml/l/hr.

During the permit cycle, the number of events per year is limited to an average of 8 and flow is limited to an average of 14 million gallons per year, averaged over 5 years.

Attached is the spreadsheet summarizing the plant's monthly operation and performance during reporting period, June 1, 1999 through May 31, 2000. As mentioned above, Settleable Solids (SS) and Total Suspended Solids (TSS) are Carkeek's permit parameters. Analysis of the data shows the plant performed within the permit limitations, without dropping a storm event.

A summary of plant performance is shown on attached spreadsheet. The average total suspended solids removal for the year was 76%, with an annual average of 34 mg/l - well under the 60 mg/l surrogate limit for 50% removal. The settleable solids event averages were consistently under the 1.9 ml/L/hr permit limit. Total flow for this period was only 8.3 MG, occurring over 6 discharge events, well under the permitted annual averages of 8 discharges events and 14 million total gallons.

Carkeek performed very well during the subject period, with all permit limits being met during the year.

Operation

This fifth year of operation was the driest to date, with the lowest annual total discharge since facility began operating as a CSO treatment plant.

There were two power outages during the reporting period, but neither resulted in a discharge. Outages should not be a problem in the future; an emergency generator project is on going. This project has experienced some delay, pending results of the Carkeek Overflow Reduction Study.

The Study was initiated because of the unexpectedly high amount of flow experienced at Carkeek. The average annual number of discharge events and total discharge volume have exceeded projected and permitted levels. In addition to the Flow Reduction Study, consultants and King County staff were reviewing the pump station hydraulics including the problems with vortexing and vibrations.

King County and Department of Ecology met in April to discuss preliminary results of the study. Assumptions used for the predictive modeling in the planning phase (mid 1980s) and subsequently in the permit, did not accurately predict the extreme flows in recent years. Modeling was based on data collected during unusually dry years. The pumping capacity to West Point appears to be lower than expected and higher flows are reaching the pump station due to conveyance changes and high inflow and infiltration rates.

The Study is nearing completion with a preferred alternative. Construction will begin as soon as possible.

Following is a summary of Carkeek's performance during this period:

- All events were used in the calculation – none were dropped under the provision for one untreated (or poorly treated) discharge per year
- 6 discharge events occurred compared to the 8 events/yr 5-year average limit
- 8.4 MG were discharged compared to the 14 MG 5-year average limit
- No settleable solids (SS) maximum event violations occurred
- The annual SS average was 0.02 ml/L/hr, compared to the 0.3 limit
- The annual Total Suspended Solids (TSS) concentration was 34 mg/L compared to the 60 mg/L limit – this equivalent to 76 percent TSS removal

Figure A2-1 Carkeek Settleable Solids (SS) Performance

June 1, 1999 through May 31, 2000

Date	Discharge Event Number	Settleable Solids (mls/L/hr)	Event Maximum (ml/L/hr)	Event Average (ml/L/hr)
24-Jun	1	<0.1	**<0.1**	<0.1
9-Nov	2		**0.2**	0.13
10-Nov	2	0.2		
11-Nov	2	<.1		
12-Nov	2	0.2		
13-Nov	2			
25-Nov	3	<0.1	**<0.1**	<0.1
26-Nov	3	<0.1		
12-Dec	4	<0.1	**<0.1**	<0.1
15-Dec	5	<0.1	**<0.1**	<0.1
1-Feb	6	<0.1	**<0.1**	<0.1
Annual Event Average				**0.02**

Details on the above information is provided below:

- <0.1 is detection limit; bold type indicates value used for the day in the event (highest when multiple tests are run during the day).
- Calculation of average settleable solids values uses 0.0 when value is < 0.1.

- Event average = average of daily values during an event.
- Annual event average = average of all event averages during the reporting year
- All events were included in the calculations.
- Flow data is reported daily from 00:00 hours to 23:59 hours.
- Sample data is taken from 00:00 hours to 23:59 hours.

Figure A2-2 Carkeek Total Suspended Solids (TSS) Performance

June 1, 1999 - May 31, 2000

Date	Inflow Event Number	Influent Flow (MG)	Influent TSS (mg/L)	Discharge Event Number	Effluent Flow (MG)	Effluent TSS (mg/L)	Discharge Event Effluent TSS (mg/L)	WP TSS removal (%)	Influent TSS lbs of solids	Carkeek TSS lbs discharged-outfall	Solids pumped to WP (TSS lbs)	Carkeek solids (lbs TSS) treated out with WP effluent	Total Carkeek solids out (TSS lbs)	Carkeek CSO Treatment "System" Removal (%)
1-Jun	1	0.29	260					0.95	628.8	0.0	628.8	31.4	31.4	**95%**
24-Jun	2	1.06	260	1	0.65	38	38	0.82	2298.5	206.0	2092.5	376.7	582.6	**75%**
2-Jul	3	0.2	572					0.92	954.1		954.1	76.3	76.3	**92%**
9-Nov	4	0.85	136	2	0.36	52	10	0.88	964.1	156.1	808.0	97.0	253.1	**74%**
10-Nov	4	0.17	111	2	0.01	52		0.9	157.4	4.3	153.0	15.3	19.6	**88%**
11-Nov	4	1.84	80	2	1.56	9		0.79	1227.6	117.1	1110.6	233.2	350.3	**71%**
12-Nov	4	5.28	73	2	4.64	7		0.71	3214.6	270.9	2943.7	853.7	1124.6	**65%**
13-Nov	4	0.16	73	2	0.02	7		0.93	97.4	1.2	96.2	6.7	7.9	**92%**
20-Nov	5	0.24	122				40	0.85	244.2		244.2	36.6	36.6	**85%**
24-Nov	6	0.22	160					0.88	293.6		293.6	35.2	35.2	**88%**
25-Nov	6	0.61	94	3	0.25	43		0.94	478.2	89.7	388.6	23.3	113.0	**76%**
26-Nov	6	0.11	89	3	0.06	26		0.91	81.6	13.0	68.6	6.2	19.2	**76%**
27-Nov	6	0.14	89					0.94	103.9		103.9	6.2	6.2	**94%**
29-Nov	6	0.06	248					0.92	124.1		124.1	9.9	9.9	**92%**
5-Dec	7	0.05	132					0.9	55.0		55.0	5.5	5.5	**90%**
6-Dec	7	0.03	132					0.92	33.0		33.0	2.6	2.6	**92%**
8-Dec	7	0.09	36					0.91	27.0		27.0	2.4	2.4	**91%**
9-Dec	7	0.05	36					0.91	15.0		15.0	1.4	1.4	**91%**
12-Dec	8	0.98	64	4	0.5	35	35	0.83	523.1	146.0	377.1	64.1	210.1	**60%**
13-Dec	9	0.05	64	5			21	0.95	26.7		26.7	1.3	1.3	**95%**
15-Dec	9	0.38	151	5	0.02	21		0.86	478.5	3.5	475.0	66.5	70.0	**85%**
17-Dec	9	0.13	151	5				0.92	163.7		163.7	13.1	13.1	**92%**
4-Jan	10	0.01	106					0.93	8.8		8.8	0.6	0.6	**93%**
9-Jan	11	0.01	102					0.92	8.5		8.5	0.7	0.7	**92%**
14-Jan	12	0.34	236					0.91	669.2		669.2	60.2	60.2	**91%**
1-Feb	13	0.83	132	6	0.32	58	58	0.72	913.7	154.8	758.9	212.5	367.3	**60%**

8-Feb	14	0.36	106					0.88	318.3		318.3	38.2	38.2	**88%**
22-Feb	15	0.03	115					0.89	28.8		28.8	3.2	3.2	**89%**
29-Feb	16	0.17	170					0.61	241.0		241.0	94.0	94.0	**61%**
4-Mar	17	0.02	106					0.77	17.7		17.7	4.1	4.1	**77%**
13-Mar	18	0.17	221					0.92	313.3		313.3	25.1	25.1	**92%**
14-Mar	18	0.08	217					0.93	144.8		144.8	10.1	10.1	**93%**
22-Mar	19	0.08	198					0.80	132.1		132.1	26.4	26.4	**80%**
Annual Totals		**15.09**		**6**	**8.39**				**14986.6**	**1162.5**	**13824.1**	**2439.9**	**3602.4**	
Annual Event Average							**34**							**76%**

Details on the above information is provided below:

- Flow data is reported daily from 00:00 hours to 23:59 hours.
- Sample data is taken from 00:00 hours to 23:59 hours.
- Carkeek influent poundage calculation: lbs = (volume in Million Gallons) x (concentration) x 8.34
- Transfer pounds out = Carkeek lbs. out + (Carkeek lbs in-Carkeek lbs out) x (1-WP TSS removal)
- Total Solids Out (Carkeek+West Point) = (Carkeek pounds out) + (transfer pounds out with WP effluent),
- Event Effluent Concentration = (total event pounds)/total event volume x 8.34)
- Annual Effluent Concentration = (sum of event concentrations)/number of events.
- Annual values were calculated using all of the events.